

BONE INJURIES
IN VEHICULAR ACCIDENTS
A RADIOLOGICAL STUDY

THESIS
FOR
DOCTOR OF MEDICINE
(RADIO-DIAGNOSIS)



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C E R T I F I C A T E

This is to certify that the work entitled
" BONE INJURIES IN VEHICULAR ACCIDENTS : A RADIOLOGICAL
STUDY", has been carried out by Dr. Rakesh Johry himself
in the department.

He has put in necessary stay in the department
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This is to certify that the work entitled
" BONE INJURIES IN VEHICULAR ACCIDENTS : A
RADIOLOGICAL STUDY ", which is being submitted as
a thesis for M.D. (Radio-diagnosis) was carried
out by Dr. Rakesh Johry under my constant supervision
and guidance.

The techniques & methods described were
performed by the candidate himself. The results and
observations were checked and verified by me
periodically.

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Dr. Rakesh Johry himself, under my direct supervision
and guidance.

His results and observations have been
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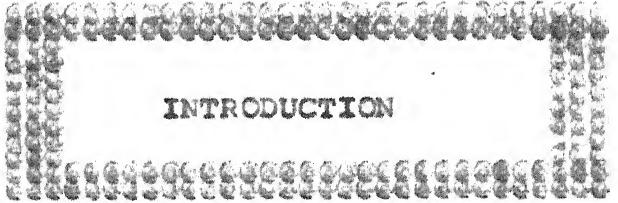
" I DEDICATE THIS WORK TO MY PARENTS AND
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Dated :

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INTRODUCTION

INTRODUCTION

The problem of road traffic accidents on a large scale has arisen for the first time since start of the present century. All other epidemics throughout history have been due to the onslaught of agencies external to man, principally the protozoa, bacteria and viruses, but road accidents are caused by man himself. An automobile accident is far too common injury as more than 18 million people have been killed, disabled or crippled in it since the manufacture of first automobile by Sir Henry Ford in USA alone.

Road accidents on high-ways are the greatest killers of young people of our country, evenmore than epidemics, tidal waves and malnutrition.

In our country as many as 24,085 persons died in 1,47,651 road accident in 1980. In 1981, 26,783 died in 1,56,903 accidents - an 11% increase in one year which is colossal. The country has an accident rate of 55 and a mortality rate of 35 for every, 1,000 vehicles, both these figures are among the highest in the world. The USA with a far higher number of vehicles on the road, has an accidental rate of only 14 per 1,000 vehicles and a

mortality rate of just 3.3. Even Japan with a higher density of population than India and more vehicles, has a low accident and low death rate of 14 and 10 per 1,000 vehicles respectively.

The incidence of accidents and deaths is more on the national and state highways, where heavy vehicles of various description play at breakneck speed, leaving little chance of survival in case of an accident. Those who do survive have multiple severe injuries.

In countries with high death rates from road traffic accidents there are peaks of mortality in the 15-24 and 65-and-over age groups.

In countries with well marked seasons there are differences in the incidence of road traffic accidents at different times of the year. Thus in winter, fog, ice and snow lead to increased vehicular collisions and longer hours of darkness are associated with higher accident rates affecting pedestrians. In the United Kingdom, the highest adult pedestrians mortality occurs in December. The danger months for cyclists, motorcycles and driver of cars are December and January, with a peak also in August.

The past world war II era saw a gradual but distinct rise in the incidence of trauma in general due to rise of vehicular accidents. Fractures occurring in two, three

or even all four limbs are no longer unusual. Moreover, one or more of the fractures is likely to be an open one, open fracture of the tibia is a common injury often produced when a motorcar strikes a pedestrian.

The present study will be carried out to assess the type of Injury, Sites involved in relation of Age, sex of the patient.

The type of Injury seen in relation to various type of vehicle involved in the accidents will also be studied.

REVIEW OF LITERATURE

- 1. PATHO-PHYSIOLOGY OF FRACTURE**
- 2. RADIOLOGICAL ANATOMY OF FRACTURE**
- 3. REVIEW OF ROAD INJURIES**

PATHO-PHYSIOLOGY OF FRACTURE

REVIEW OF LITERATURE

Fracture is defined as breach or discontinuity in the cortex leading to displacement or disfigurement of the bone.

Dislocation : A joint is dislocated when its articular surfaces are wholly displaced one from the other. So that all opposition between them is lost.

Fractures may be subdivided, according to their aetiology into three groups - (i) traumatic fracture; (ii) fatigue or stress fracture; and (iii) pathological fracture.

Traumatic fracture : These fractures form by far the largest group. They occur through bone that was previously free from disease. Such fractures may be caused direct violence or by indirect violence.

Fatigue fractures : Fatigue or stress fractures occur not from a single violent injury but from of repeated stress why they should occur in bones that show no evidence of disease - has not been determined precisely. They have been linked to the fractures that occurs in certain metals, when "fatigued" by repeated stress.

Pathological fractures : The term pathological is applied to a fracture through a bone already weakened by disease. Often the bone gives way from trivial violence or even spontaneously.

Clinical Classification :

Clinically, a fracture may be classified as simple; compound; comminuted and crush fracture.

Simple fracture : A fracture is simple when there are only two fragment without breach in soft tissue or skin.

Compound fracture : A fracture is compound when there is a wound of the skin surface leading to exposure of bone to exterior.

Comminuted fracture : A fracture is comminuted when more than two fragments without communicating externally.

Crush fracture : A crush fracture occurs in cancellous bone and is caused by direct compression, so that the cancellous substance is impacted into itself.

Bone fracture both from direct and indirect trauma, which may be classified.

Direct Trauma : Perkins divides fractures due to direct application of the force to the fracture site into tapping fractures, crush fractures and penetrating fractures.

Tapping fractures occur when a force of dying momentum is applied over a linear area. The identifying fractures of the fracture are the transverse fracture line, and the finding that, frequently, in the arm or leg only one bone is fractured.

Crush fracture may be accompanied by extensive soft-tissue damage. The bone is either extensively comminuted or broken transversely. Penetrating fractures are produced by projectiles.

Indirect Trauma : Fractures produced by a force acting at a distance from the fracture site are said to be caused by indirect trauma.

Traction or Tension fracture : The shaft of long bone is most unlikely to be pulled apart by traction or tension force. The fracture line is, transverse.

Angulation fracture : In this the convexity of a bone is under a tension stress, the concavity is under compression. This progression gives rise to transverse fracture, although frequently the cortex under compression splinters before the fracture is complete.

Rotational fracture when a rotational stress is applied to a long bone, it fails with a spiral fracture line at 45 degrees to its long axis. The upper and lower ends of the fractures are connected by a vertical component.

Compression fracture long bones are not uniformly cylinders and are only rarely fractured by a pure compression force. The hard shaft of the long bone is driven into the concellous end, giving rise to the T or Y shaped fracture at the lower end of the humerus or femur.

RADIOLOGICAL ANATOMY OF FRACTURE

The bone injuries in the vehicular accidents are presented either dislocation or fractures or both. A dislocation is complete disruption of joint so that the articular surfaces are no longer in contact. Subluxations are minor disruptions of joints where partial articular contact still remains. Parkins states that most subluxations are associated with fractures of the joint. Fractures may be open, when the overlying soft tissues have been breached, exposing the fracture to the external environment, or closed, when the skin is still intact. Most fractures occur as the result of a single episode by a force powerful enough to fracture normal bone.

CRANIO-VERTEBRAL INJURIES :

Head injuries account for approximately three-fourth of all injuries sustained in automobile accidents. Fractures of the vault and base of the skull are produced - (1) by compression of the sphere; (2) by local indentation, and (3) by tangential injury. Fracture may be either linear or fragmentary with a simple separation of the tables or a depression of both cranial tables. Depressed fractures are usually quite fragmentary and they may also be communicating (compound) with an associated injury of the dura and underlying brain.

VERTEBRAL FRACTURE :

The vertebral fractures are of three types :

- (i) Incomplete fracture;
- (ii) Fracture dislocations; and
- (iii) Burst fractures.

(i) Incomplete fractures : Incomplete fracture do not interfere with continuity of the spinal column. They include fractures of the spinous and transverse processes, laminae and fissured or compression fracture of a vertebral body. Fractures of the processes or laminae are usually due to direct violence. Fractures of the spinous processes are common in the dorsal region for the processes are long and exposed to injury in falls on the back. Shovellers' fracture is a 'stress' fracture of spinous processes which occurs in men who use a shovel excessively, especially if they are undernourished. Localised pain and perhaps crapitus suggest the nature of the injury which is seldom shown by radiography. Fracture of the transverse processes occurs most usually in the lumbar region, where these process are long and comparatively unprotected.

(ii) Fracture dislocations : Fracture dislocations of the spine involve complete disruption of the column with rupture of the interspinous ligament, fracture or dislocation of the facet joint and a fracture through

the vertebral body. These are commonest at the dorso-lumber junction and result from a combination of flexion and rotation violence. They may also occur in the cervical spine although greatly out numbered here by pure dislocations. The majority of these injuries are accompanied by damage to the spinal cord and the cauda equina.

(iii) Burst fracture : Burst fractures are commonest in the mid-cervical and mid-lumbar regions. These are the result of axial violence such as a fall on the vertex or on the heels and buttocks. The vertebral body disintegrates as the name suggests and posterior protrusion of portion of it frequently cause damage to the cord especially in the narrow cervical region.

Chance's fracture, this fracture has appeared in modern injuries of the spinal column usually lumbar injuries, associated with lap seat belt. It is possible that Chance's fractures may be a pure tension injury rather than having any horizontal shear for the characteristics of such a fracture are :

1. Longitudinal separation of disrupted posterior elements - body or ligamentous.
2. A minimum decrease in anterior-vertical height of the involved vertebral body.

3. Little or no forward displacement.

4. Usually occurring in the first and third lumber vertebra.

Most of these injuries have been recorded as being associated with seat belt injuries.

It is the velocity of the injuring object that will determine the type of skull fracture produced linear fractures are usually produced by low velocity injuries and depressed fractures by high velocities. Experiments by Gurdjian (1953) and associates show that a steel pallet three-fourth of an inch in circumference traveling at 50 feet per second will produce a linear fracture on striking the exposed skull of a cadaver. The same pallet traveling at 90 feet per second will produce a perforation of the skull with a depressed fracture. Approximately 500 pounds or more per inch of pressure is required to produce a linear fracture. Only 0.05 second is needed for this impact to produce a maximum deformation. The scalp is deformed in about 0.002 second and the skull in about 0.004 second after onset of impact. The extent of a linear fracture may, therefore, be taken as a relatively good index of the severity of the blow and a rough measurement of the severity of traumatic unconsciousness.

Roaf (1960) emphasized the fact that most severe spinal injuries comprised the summation of multiple forces including compression, flexion, extension and rotation. These injuries are augmented when the intervertebral disc has lost its, turgor and degenerated, so that rotational and torsional effects are exaggerated. The position of the head & neck and the alignment of the cervical segments at the moment of impact also influence the complexity of the fracture.

Whiplash injuries of the neck : Varying degrees of cervical injuries may occur when the head suddenly accelerates in relation to the trunk, as in the so-called whiplash injury of rear-end automobile collisions. The extension component of the recoil or oscillating neck motion is the significant mechanism in these injuries (Macnab, I 1964), which are usually milder than those which result from a direct impact on the head. The large majority of cases involve a non-complicated cervical muscular or ligamentous "Sprain". Occasionally, these are associated disc or nerve root injury, subluxation due to stretching or tearing of ligaments or fracture (Frankel CJ, 1959).

Trauma incident to automobile accidents in which the patient has a cross-chest seat belt in place also can

produce such fractures, together with injury to the adjacent lateral masses and paravertebral ligaments. Hamilton (1968) speculated on the possibility of an increase in the incidence of upper spinal injuries because of the use of combination restraining belts. Saldeen (1967) reported fatal neck injuries caused by use of diagonal belt. He examined 3 cases in which the cross-chest belt resulted in fractures in the transverse processes of C₇ & T₁ together with a fractured clavicle in patient and in another there was dislocation of C₇ on T₁ with quadriplegia. In the third a vertical fracture passed through the spinous process of C₆ together with a compression fracture of C₇. These fractures are probably due to a sudden deceleration by the seat belt with flexion and torsional forces exerted against the lower cervical spine, the belt acting as a fulcrum for this leverage.

Pars interarticularis fractures occur as a result of trauma, or may be incident to stress, such as occurs in athletes or dancers, who have repeated small traumas to the area in the course of their work. The relative infrequency of these is indicated by the fact that Wilson and Katz (1969) found only 1 in 250 cases of stress fractures in military trainees. Such fractures incident automobile accidents were mentioned by Roche (1948), and after a football injury by Melamed (1965).

Atlanto-occipital dislocations are infrequent, and usually are traumatic in origin. Survival is rare because of cord and medullary injury (Everts 1970), and fracture precedes ligamentous tears because of the strength of ligaments. Everts mentions that in children the occipital condyles are small, and the plane of the atlanto occipital joints almost horizontal, so that dislocation is possible. In adults because of the steep inclination of the occipito-atlantic joints dislocation without fracture is unlikely.

Sacrum and coccyx fractures usually follow direct trauma, such as a fall or a direct blow. Traffic accidents with pelvic injuries account for relatively few sacral fractures. Ryan (1971) observed 24 sacral fractures out of 387 pelvic fractures and/or dislocations, with the largest number at the rami, acetabulum and ileum.

FRACTURES OF MAXILLO FACIAL BONES :

Maxillo facial injuries, and cervical injuries are more common with high speed travel, fast moving machine parts in industry and high speed missiles in warfare. As Americans and indeed people all over all the world, have taken to the high ways, facial impacts against wind shields and dash-boards have multiplied the number of injuries alarmingly. Other major causes of facial injuries are fist fights, motorcycle and bicycle accidents, falls, epileptic seizures and a variety of athletic and reactional activities.

Angle's (1899) classification of dental occlusion is based on the relationship of the mesiobuccal cusp of the maxillary first molar tooth to the mandibular teeth below. In patients with normal bite relationships, this cusp interdigitates in the mesiobuccal groove of the mandibular first molar tooth. With disocclusion (retro-occlusion or class II malocclusion), the mesiobuccal cusp of the maxillary first molar is anterior to the mesiobuccal groove of the mandibular first molar. The reversed displacement is known as mesioocclusion (prognathic occlusion or class III malocclusion). In this instance, the mesiobuccal cusp of the maxillary first molar is in the space between the first and second mandibular molars. Lateral blows to the upper or lower jaw may produce either a unilateral or bilateral cross bite as a result of a horizontal fracture and segmental medial displacement of one or both alveolar processes with their contained teeth. In such instances the full vertical height of the mandible or maxilla may or may not also be fractured.

Fractures of the maxillae (Middle face fractures) :

In 1900 Rene Le Fort carried out classic experiments to determine the portions of greatest weakness within the maxilla. His work has resulted in a classification of fractures of the maxilla that is now widely used.

LEFORT - I FRACTURES (Transverse maxillary fracture of Guerin) :

This is a transverse fracture in which the fractured segment contains the upper teeth, the palate lower portions of the pterygoid processes and a portion of the wall of the maxillary sinus.

LEFORT - II FRACTURES (Pyramidal fractures) : In these fractures the fragmented segment also includes the nasal bone and the frontal processes of the maxilla. The fracture lines usually run through the lacrimal bones and inferior rim of the orbit, continuing downward near the zygomaticomaxillary suture. The fracture line then extends beneath the molar bone toward the pterygomaxillary fossa. This often produces significant widening of the inner canthus of the eyes, epicanthal deformity of the bridge of the nose and destruction of the ethmoidal sinus cells.

LEFORT - III FRACTURES (Cranio-facial disjunction) : In this fracture, the maxilla, nasal bones and zygomatic compound are all separated as a unit from the cranial attachments. Such injuries usually involve multiple additional fractures, within this large mobile segment.

STERNAL FRACTURE :

Tarnowsky (1905) gave a comprehensive account of sternal fractures and divided the causal factors into direct, indirect violence and muscular action in descending order of frequency.

Direct violence : This is the most usual cause and the steering wheel is the common injuring agent. Gibson, Carter and Hinshaw (1962) described five fractures of the manubrium in a series of eighty sternal fractures. Three of these patients with a manubrial injury died of associated visceral injury.

Indirect violence : The injury is usually produced by a fall on to the head and neck, by the fall of a heavy object on to this area or more rarely by a fall on to the buttocks. The force is a violent one and there is commonly an associated vertebral fracture (Gurtt, 1964; Kirkham, 1941; Fowler, 1957). The sternum is damaged at one of three sites- (1) the sternomanubrial joint, which dislocates; (2) the upper pieces of the sternum, which fracture; and (3) the manubrium, which fractures.

ZYGOMA FRACTURES:

Knight and North (1961) have made a most useful classification of zygoma fractures. Based on their studies, there are six common types of malar bone fractures :

1. One in 20 fractures of the malar compound shows no significant displacement, and treatment is not required.
2. One in 10 involves only the zygomatic arch. In this fracture pattern there are typically three fracture lines of the arch with a buckling in the fragments.

3. One third of malar compound fractures produce unrotated fractures of the body of the zygoma, with displacement directly into the antrum (backward, inward and slightly down ward).
4. One in 10 fractures of the malar compound is medially rotated. The left malar compound in such injuries is thus rotated counter-clockwise (or clockwise in the case of a fracture of the right malar compound) when viewed from the front. Examination of the waters view roentgenogram shows apparent downward displacement at the infra or bital margin.
5. One fifth of the malar compound fractures are laterally rotated and apparently caused by blows below the horizontal axis of the bone. When such fractures involve the left malar compound it appears to be rotated clockwise when viewed from the front (i.e. away from the midline). On roentgenogram with the waters view, these fractures often appear to be displaced upward at the infra orbital margin.
6. Finally, about one-fifth of the malar compound fracture are complicated by additional fracture lines through the dense bone of the main fragment.

FRACTURE OF THE MANDIBLE :

This may be divided for simple classification into four groups :

1. Fracture of the condylar neck : This is the weakest portion of the mandible and accounts for 35 percent of the fractures.

2. Fractures of the mandibular angle, ramus and coronoid :

This portion of the bone lies beneath the masseter and temporal muscles and accounts for 30 percent of the fractures of the mandible.

3. The body of the mandible and/or the alveolar ridge with its contained tooth roots :

This accounts for 25 percent of mandibular fractures.

4. Anterior mandibular fractures : These fractures involves symphysis and mandible from midline back to the mental foramen on either side. They account for 10 percent of mandible fractures.

FRACTURES OF LIMB BONES

MONTEGGIA FRACTURES :

This fracture of the upper third of the ulna with dislocation of the head of the radius was described by monteggia in 1814. The head of the radius is dislocated both from the upper radio-ulnar articulation and from the elbow joint. It may be displaced anteriorly or posteriorly according to the angulation of the ulnar fracture.

Monteggia-fracture dislocations may occur from either flexion or extension forces and there are two corresponding types of injury. The flexion injuries account for only 10-15 percent of cases the fractured ulna is angulated with the convexity posteriorly and the head of the radius is dislocated backwards. The extension injury is the common type of monteggia fracture accounting for 85 to 90 percent of cases. The fractured ulna is angulated with its convexity anteriorly and laterally, and the head of the radius is dislocated forward and to the lateral side.

Bennett's fractures :

In 1881 Edward Bennett, Professor of Surgery at Trinity College, Dublin, who had earlier worked in the Anatomy Department, where he was able to collect many specimens of bone pathology, reported to Dublin Pathological Society a type of fracture which he had observed in specimens of human bones, involving the base of the first metacarpal and detaching part of the articular facet with the piece of bone supporting it which projects into the palm. He had deduced that this fractures must be accompanied by subluxation of the joint, and had later seen a patient in whom he was able to confirm this. In 1885, he published a further report in which he said that he had now seen a great number of examples both of the recent injury and of the united fracture.

Fracture of the tuberosites of the tibia

Many groups of fracture of the tuberosites have been described by Clarke et al in 1934 but only one subdivision is of clinical importance of the two types, each has a distinctive etiology, radiographic appearance, method of treatment, and prognosis - (1) depressed fracture without comminution, without injury to the articular surface, and in which there is no subluxation of the tibial fragment; (2) comminuted fracture with separation of a marginal fragment often severe injury to the articular in which, on occasions, there may be subluxation of the tibia (Stamm, TT, 1434).

Galeazzi (1935) fracture :

As fractures of the upper shaft of the ulna are associated with dislocation of the upper end of the radius, so fractures of the lower end of the radius are associated with dislocation of the lower end of the ulna. This fracture dislocation with angulation of the radius and dislocation of the inferior radio-ulnar joint, shows the same tendency to redisplacement after reduction as does the corresponding fracture-dislocation of upper forearm. The fibrocartilage of the inferior radio-ulnar joint may remain intact, it may be ruptured, or it may avulse the slyloid process of the ulna.

It has been suggested by Mervyn Evans (1449) that the fracture of the shaft of the ulna with dislocation of head of the radius (Monteggia fracture) are sustained from a fall on the out stretched hand with twisting of the trunk, forcibly, pronating the fore arm. If this is correct then supination is essential for reduction and a safeguard against recurrence of displacement. This injury does not always arise from forced pronation, and immobilisation in supination is not always successful in preventing displacement. A monteggia fracture can result from a direct injury. It is common fracture in Africa, where the usual cause is a direct blow on the back of the forearm with a stick while the arm is raised warding off an attacker. The ulna fractures, angulates forwards, and the head of the radius is driven anteriorly. It may be that a Monteggia fracture-dislocation is sometimes caused by the mechanism described by Mervyn Evans and sometimes by direct violence.

The Hume fracture : In 1957 Hume described three cases of fracture of the proximal ulna associated with forward dislocation of the head of the radius occurring in children. This fracture is basically a high monteggia injury, but it is frequently misinterpreted in the initial X-ray when the dislocated head of the radius is mistakenly thought to be an isolated injury.

Classification of transcervical fractures of the femur :

Garden (1961) has used the observations of Per Linton to establish four stages in the development of cervical fractures and has shown convincingly that the direction of the fracture line remains remarkably constant throughout. These stages form a useful classification of the fracture. They are :-

1. Incomplete fracture : The so-called 'abducted' or 'impacted' injury in which the inferior cortex has not been completely breached.
2. Complete fracture without displacement : The inferior cortex of the neck has broken but no tilting of the head has occurred.
3. Complete fracture with partial displacement : Full lateral rotation of the distal fragment has not occurred, and the distal hinge on the proximal fragment tilting it into abduction and medial rotation.
4. Complete fracture with full displacement : The distal fragment has now fully rotated in a lateral direction. Intimate contact between the two fragments has been lost, allowing the proximal fragment to resume its natural position in the acetabulum.

Injuries of the Thigh :

The basic fracture pattern of a femoral shaft injury associated with the severe trauma of a road traffic accident is usually transverse, indicating direct trauma. But this appearance may have many variations which at their worst may take the form of gross disruption of continuity of a whole section of the femoral shaft. Pure spiral fractures resulting from indirect violence are less common and tend to occur in an older age group.

Fractures of the Phalanges :

Jones, in 1962, reviewed the results of 196 fractures of the proximal and middle phalanges. 96 were judged to be stable, and 76 of these regained full function; of the others 16 had slight loss of movement and only four had serious loss of movement. In contrast, only 19 of the 100 unstable fractures regained full function.

Epiphyseal fractures :

The Salter - Harris type 2 epiphyseal fracture is the commonest type in the hand as elsewhere. This is a fracture-separation with the line of injury passing along the growth plate and then distally through the metaphysis so that a triangular metaphyseal fragment displaces with

the epiphysis from the rest of the metaphysis. Another common type of fracture runs transversely through the metaphysis, a few millimeters distal to the growth plate, this is not, strictly speaking, an epiphyseal fracture but in practice can be classed with them for it is similar in incidence and prognosis to the type 2 injury and it may be difficult on the original radiographs to distinguish between them.

Vertical compression injuries of the ankle :

The ankle joint is designed to bear weight and supports up to three times body weight during the push off phase of normal gait.

Ruedi and Allgower (1969) divided three injuries into two main types - anterior compression fractures caused by axial impaction of the dorsiflexed talus, the commonest variety; and posterior compression fractures caused by a fall on to the planter-flexed foot.

FRACTURE-DISLOCATION INJURIES OF THE JOINTS :Side-Swipe fracture-dislocation of the elbow or baby car fracture :

This is a fracture dislocation of the elbow with forward displacement of both forearm bones, fracture of the olecranon, fracture of the lower shaft of the humerus and fracture of the upper shaft of the ulna, sustained by drivers of cars who while resting an arm with the elbow projecting through the window met oncoming cars too closely. Originally, it was thought that the injury was the particular penalty of small 8 bhp cars, in which there was no room to move and thus it was described as the 'baby-car-fracture'. But the same fracture dislocation soon occurred even in the roomy and luxurious cars of America. These drivers also indulged in putting their elbows out too far, and to they quickly found a better little - the sideswipe fracture.

Injuries of the Ankle :

Based upon cadaveric experiments and the careful study of a series of ankle injuries from both clinical and radiological point of view, Lauge-Hansen (1950) devised what has been termed the 'genetic classification'. It is based upon the concept that each of the various patterns of fracture-dislocation of the ankle is the end product of sequence of bony and ligamentous fracture which results

from a deforming force and that for any given deforming force the failure sequence usually occurs in the same order to produce the complete injury pattern which is pathognomonic of that deforming force. Should that force cease to act at any point in the sequence a partial failure pattern will result. With minor modification of terminology a simplified 'genetic' classification is used. There are six groups of ankle injuries :-

1. Abduction injuries
2. Adduction injuries
3. External rotation injuries with diastasis of the inferior tibio-fibular joint : pronation external rotation injuries.
4. External rotation injuries without diastasis of the inferior tibio-fibular joint : supination external rotation injuries.
5. Vertical compression injuries.
6. Uncommon unclassified injury pattern.

Essex Lopresti fracture-dislocation :

Sometimes the upper end of the radius is fractured by longitudinal (axial) compression of the forearm. This occurs while pushing a loaded truck with the wrist dorsiflexed and the elbow extended when the truck suddenly stopped. The radius is driven forcibly against the

capitellum and the head of the radius fractured; at the same time ulna is dislocated at its lower end. The true nature may sometimes be disclosed in radiographs of the elbow alone which show impaction of the neck of the radius into the middle of the comminuted fragments of the head with shortening. Radiographs of the inferior radioulnar joint will confirm the displacement and must be taken in every comminuted fracture of the head of the radius.

FRACTURES OF THE HIP :

Dislocation of the hip joint with fracture of the shaft of the femur :

This rare combination of injuries was first described by Sir Astley Cooper in 1823. Papers reviewing the problem emphasise that in the literature over half the cases were diagnosed late or not at all (Dehne & Immernonn, 1951); (Halal & Skevis, 1967). To avoid missing the diagnosis, there should be a routine check up of the hip for bony deformity and bruising in every fracture on the shaft of the femur. Halal and Skevis (1967) observed that in all their cases X-rays showed a transverse fracture with adduction of the upper fragment, whereas, in most uncomplicated fractures of the femoral shaft the upper segment is abducted; if it is adducted the fracture line is never transverse but directed obliquely downwards and medially.

Central fracture-dislocation of the hip joint :

They have been classified into a number of varieties, some of which can be improved by operative measures. Although a number of classifications have been suggested by Judet R; Judet J & letournel E et al (1964), basically two distinct fracture of the acetabulum can be recognised : Group 1 with an intact weight-bearing articular surface and Group 2 in which the acetabulum has been reduced to a bag of bones. The mechanism of production of these two fracture is probably quite different. Group-2 fractures are the result of a direct injury to the side of the greater trochanter and pelvis, such as, seen when a pedestrian crossing the road is knocked over by a car; and indeed this type of fracture has been produced experimentally by applying a direct force to the greater trochanter (Pearson & Hargdon, 1962). Group-1 fracture, on the other hand, are the result of a more complex system of forces applied trochanter and also along the shaft of the femur from the knee; this is the combination of forces which commonly prevail in a high speed motor accident, the dashboard injury to the knee providing the femoral thrust, while a side swipe blow on the car produces the direct injury to the greater trochanter.

REVIEW OF ROAD INJURIES

Accident represent a major epidemic of non communicable disease in the present century. In developed and many developing countries road traffic accidents are now main cause of death and disability, particularly in young adults. World statistics are incomplete but are sufficient to give an out line of this man-made twentieth century epidemic.

Since India became independent, there has been a tremendous development in industry, construction of new road and increase in heavy and high speed traffic. Farming has been completely mechanised in certain states, over the years. This change in the country's complexion has led to a marked increase in accidents on roads, in factories and on farms. Accidents can be classified as follows :-

1. Road accidents : Road accidents are the most common important regarding mortality and morbidity.
2. Farm accidents.
3. Industrial accidents -
 - (a) Organised industries i.e. factories.
 - (b) Unorganised industries i.e. small scale cottage industries (Agarwal, ND, 1985).
 - (c) Domestic accidents and;
4. Rail accidents and disasters.

According to a study carried out by the transport and Road Research Laboratory in Britain, Metropolitan cities in developing countries have higher accident rates than those in developed countries. For instance Bombay, Bangalore and Delhi lead in the number of casualties per 10,000 vehicles 800, 445, and 318 respectively. As for the number of fatalities, the figures are 53, 36 and 40 respectively. "These figures are the highest among various cities in the World" added Guarantee.

Accidents on Indian roads seem to be mounting in the same proportion as the increase in the number of vehicles. In 1960, there were 38,818 recorded accidents which took a toll of 4,491 lives. The vehicle number then was about 6.5 lakhs. In the next two decades, the vehicle number went up six times to 39 lakhs and so did the road accidents to 1,47,651 and mortality to 24,085 (Agarwal, 1985).

Ibrahim (1966) stated in weekly news paper that in India during seven years immediately preceding December, 31, 1964, the motor vehicle accident rose by 151 percent, while the automobiles and the population increase was only 96 and 17 percent respectively. On the basis of deaths per 1,00 vehicle, India is already in second highest position amongst the countries of the world.

In India, accidents are definitely on the increase. Between 1957 and 1979 accidents increased by 461 percent, while in same period, the increase in population was 156 percent and increase in the number of vehicles was 1677 percent. In absolute number 40,000 people were killed in road accidents in 1986, as against 24,600 in 1980. India has a fatality rate in road accidents that is 20 times that of developed countries (Park, 1989).

There were only 2 motor vehicle accident deaths in Great Britain in 1898 while in USA only one person died in 1899. But in 1957 there were 102,532 deaths in automobile accidents in 47 member countries of W.H.O. alone (WHO, 1962).

According to WHO (1965), the annual deaths due to traffic accidents have more than doubled in 10 years in many countries. Similar trends are reported from several developing countries.

According to Surgeon Counsel of Britain total 10,56,207 accidents occurred in 1981 out of which 50,147 died on the spot.

According to Medical Bulletin of Japan 47,267 accidents occurred in 1975.

Total people survived accidental injury in New York in 1978 were 9,67,642 out of which death occurred in 29,042.

In Scandinavian countries the accident rate is very high in relation to the population of other western countries.

Accidents are now one of leading cause of death in Western countries. Total number of death due to accident in USA exceeded one million (actual 10,38,430) in Great Britain-40,988, in Japan-40,447, West Germany - 35,295, in France-32,955, Italy-23,171, Mexico-19,831, Poland-11,838, Canada-10,569 (Seal SC, 1964).

A ROAD TRAFFIC ACCIDENTS :

In many countries motor vehicle accidents rank first among the all fatal accidents. There are almost 300,000 deaths from road accidents annually in the world and the fatal casualties number upto 10 million. In addition every death, there are as many as 30 to 40 minor injuries and 10 to 15 serious injuries requiring long period of expensive care, nursing and treatment (WHO, 1981).

In USA (1957) deaths at all ages from road traffic accidents (38,702) exceeded these due to all infectious & communicable diseases (WHO, 1961).

In India, accidents have increased from 72,000 in 1965 to 1,07,000 in 1968 while number of death increased from 8,392 in 1965 to 12,555 in 1968. Eight persons are killed per 1000 vehicles in India whereas in Britain, France, West Germany, Italy and USA, the death figure per thousand vehicle is only one (Park, 1981).

According to Leo A. Kaprio about 2,50,000 people or more are killed on the roads of the world each year. In 1974, 50,000 people died in the USA as a result of road traffic accidents. In three countries of Europe, Italy and the U.K. nearly 35,000 were killed in road accidents. In 1973, there were over seven million injured in road accidents throughout the world. Among those who died 90,000 were first hospitalised for period upto 30 days. Two million motor vehicles on India's roads its people suffer a road death toll ten to fifteen times greater than U.K. and USA (Swasthya Hind, 1979).

It is estimated that 11,142 road accidents were reported in Tamil Nadu, during 1970. In these, 1039 persons were killed and 9,370 injured. It is rather shocking that the total number of accidents in Tamil Nadu during 1976 were 11,655 (Christopher Daniel, 1973).

India is one of the highest road accident rate country in the world. One out of 42 vehicles in the country met with accident in 1986. In U.S. and Europe the average is 1 in every 100 vehicles. In 1986, 40,000 people were killed in road accidents as against 24,600 in 1980. The number of people injured in road accidents doubled in past six years, touching 1.75 lakh in 1986 (Park JE, 1979).

From his study of about 35,000 accidents over 19 years Schulzinger (1956) found that the peak was at 21 years within the range of 17 to 28 years.

Out of 21,597 casualties and fatal accidents records analysed by Charpure et al (1952a & b). The age group of 10-35 years was found to be most affected.

Males under 30 especially between 18 and 23 years contributed heavily to the accidents than those beyond. Young adults and teen age drivers are also found to be involved in a disproportionately large number of single vehicle accidents (Mc Farland and Moore, 1957).

Mc Farland (1957a) stated that for drivers past middle age due to impaired efficiency of senses and slower reaction time the rate tends to increase though many of them compensate by slower driving, less driving at night etc.

According to Norman (WHO, 1962) adult and middle aged driver, have lower accident rates. Lowest is between 50 and 60 years.

The general excesses of males in road fatalities has its peak in the young adult where the sex ratio is 10 : 1 (Backett, 1959).

Lauer (1952) stated that apart from being the major contributor in road accident, male drivers also take 5 years before improving their accident record. Females on the contrary show improvement from the start. But according to Mc Farland and Moore (1960), it is difficult to say

whether females are safer drivers or not because of disproportionate hours of driving between the two sexes.

In United Kingdom (1958) only 7,481 (2.5%) of 2,99,767 casualties in road accidents were considered by the police at the scene of accident to be due to defect in brakes, tires and steering.

In study of vehicular defects in eleven states of United State (National Safety Council, 1960), about two out of five vehicles tested, were found unsafe, among individual states, four had vehicle rejections exceeding 50% and the highest was 72%. Head lights led the list, being defective on 24% of all vehicles. In order of frequency defective brakes - 17%, rear light-15%, steering-10%, glass-5%, and tires-1 percent.

According to National Safety Council (1960) in United States 7.2% of drivers involved in accidents were considered to have visual obstruction on the vehicle (e.g. rain, snow, or wind shield, other wind shield obstruction lead on vehicle), in the United Kingdom (Great Britain, Ministry of Transport and Civil Aviation, 1959a) only 64 of 2,99,767 road casualties were considered to be due to the cause.

Pedestrians obviously come from encounter with motor vehicles. The legs are the chief sites of injury, though impact with the bumper, but the head in case of life threatening injuries - which are more often caused by striking the vehicle, especially with the wind screen than the ground (Ashton, Paddor and Mackay, 1977).

For motor cycle riders the main cause of death is also head injury, but severe injuries to chest and abdomen are common. A feature of motor cycle fatalities is both the multiplicity and the great severity of trauma sustained. For surviving motor cycle riders injuries to the extremities occur with great frequency, those to the legs often cause significant long term disabilities.

A feature of motor cycle casualties in industrialized countries in particular is a very significant proportion of survivors with serious brain damage. Rehabilitation prospects for those casualties are poor and cost of health care is extremely high.

For bicycle riders head injuries predominate amongst both fatal casualties and survivors. Lower limb injuries are fairly frequent, and a specific problem of foot injuries to child cyclist from spokes has been identified.

for car occupant, in fatal cases both head and chest injuries are of almost equal importance, among survivors lower limb injuries are a frequent cause of disabilities. The use of seat belts by car occupants reduces the risk of all types of injuries. Among car occupants who are injured, the use of seat belt changes the anatomical distribution of injuries and also for collision of equivalent impact severity, reduces markedly the risk of specific injuries. For unbelted occupants ejection is still identified as an important mechanism of injuries, although it has been reduced with introduction of anti-burst lock designs in car doors.

For occupant of light vans, pattern of injury very significantly from those of car occupants. Ejection is more important mechanism of injury, lower leg injuries occur more frequently.

For occupants of truck, injuries differ substantially from those of car occupant. Severe injuries to the lower leg are particularly prominent amongst serious casualties, chest and head injuries are relatively less frequent. Fatal injuries are strongly associated with massive intrussion of car structure or with ejection of the occupants (WHO, 1979, Europe).

A most important aspect of the road traffic accidents problem is the disproportionate mortality and morbidity from road traffic accidents in the 15-24 years of age. In many countries road accidents account for between 40% and 50% of all deaths among males in this age group. These statistics raise serious issues for public health authorities. In the first place they indicate that road accidents are far more important in terms of loss of expectation of life than in the overall mortality statistics. In the second place, it is important to realize that this peak mortality, which predominantly effects young male drivers of motor vehicles, is occurring at a time of life when physiological performance, which is thought to play such an important part in determining a driver's risk of being involved in an accident, will never be better. In the later decades of life, when eye-sights, hearing and the reactions are beginning to deteriorate, the risk is minimal (J.D.J. Havad).

Road accidents are the most frequent cause of serious multiple injuries but they share with falls from heights the power to apply great forces to many parts of the body (Kullowski, 1960). A typically severe combination of injuries is seen in pedestrians, who are knocked down and suffer damage to the head, shoulder, chest, pelvis,

thigh and leg, all cited on the side of impact. Reviewing fatalities from road accidents, Cissane and Bul (1961) found that 183 victims suffered a total of 593 significant injuries. The occupants of vehicles suffered slightly less injury than pedestrians and cyclists of various kinds but there were, on average, over two and a half significant injuries each.

Gautam Chosh (1990) stated in weekly newspaper that Delhi has higher fatality and injury rates than the other metropolis and nation wide. In addition, a mishap victim in Delhi either dies or is injured. There were 22 deaths and 103 injuries in Delhi for every 100 road mishaps in 1989 while in Madras 8 and 79 respectively as shown in chart number - 1.

Chart number - 1

Showing Deaths, injuries for every 100 road mishaps in three metropolis, two states and all-India.

	Delhi 1989	Madras 1989	Banga- lore 1989	Tamil Nadu 1989	Karna- taka 1988	All India 1988
Deaths	22	8	8	19	19	20
Injuries	103	79	92	81	125	89

Chart number-1 shows that there were 8,50,000 cyclists in Madras last year drivers of faster vehicles were responsible for 350 fatal accidents. The figures for other cities also tell the same table.

Chart number - 2

Showing Traffic data for three metropolis
for 1989

	Delhi	Madras	Calcutta
Total no. of vehicles	15,80,450	5,30,107	3,58,400
No. of cycles	9,422	8,50,000	90,000
No. of accidents	7,192	5,551	2,982
Average no. of vehicles for each accident	220	95	120
Traffic police strength	1,713	2,107	1,938
Length of roads (in Km.)	18,073	1,800	not available
Average length (in Km.) manned by police	10.55	0.85	-do-
No. of mishaps for each 10 Km. of road	4	31	-do-
No. of vehicles on each Km of road	88	767	-do-

Row 4 shows that for every 220 vehicles, there was one mishap in Delhi, compared with one for every 95 in Madras and 120 in Calcutta. There are 88 vehicles, including bicycles, piled on the average on one kilometre of road in Delhi compared with 767 in Madras. This means the traffic density in Madras was nearly nine fold of that in Delhi. For every 10 Km. of road in Delhi, there were only four accidents whereas the figure in Madras was 31 more than sevenfold.

It is estimated that 8958 road mishaps were recorded in Delhi during 1989, out of which 1,581 persons were killed and 7377 injured while in Madras 445 persons were killed and 4358 injured and in Bangalore 6043 accidents occurred out of which 512 people died and 5531 injured as shown in chart number - 3.

Chart number - 3

Showing Road Mishaps in 1989

Road users	Delhi		Bangalore		Madras	
	Killed	Injured	Killed	Injured	Killed	Injured
Pedestrians	666	2,392	204	1,645	226	2,158
Cyclists	208	592	73	550	91	1,224
Others	707	4,393	235	3,336	128	976
Total	1,581	7,377	512	5,531	445	4,358

MATERIAL & METHODS

MATERIAL & METHODS

The present study was carried out in the department of Radio-diagnosis, Maharani Laxmi Bai Medical College & Hospital, Jhansi. The study was carried out of those patients, who have suffered from bone injuries in vehicular accidents and admitted in the emergency ward of this hospital.

The following material was used for the study :

1. X-ray films, cassette & screens;
2. X-ray machine, developer & fixer solution;
3. Illuminating box.

The patients with a suspected skeletal injury were investigated methodically. Basic x-ray examination require A.P. & lateral position radiography. These views were taken by placing the film directly beneath limb or part of body loaded in the cassette with screens.

F.P.D. was 3 feet and x-ray beam was focussed at the site required for visualisation. The K.V. 45-55 and MAS 50-55 were used. After exposing the film, the film was processed manually at 27°C room temperature.

Then examined over the illuminating box, the few special site require the special radiographic view e.g. skull - AP, Lat, PA, Tangential and basal views; nasal bone axial occlusal view; shoulder AP, Lat, axial view; scaphoid - PA, Oblique, Lateral view; Calcaneum - Lat & axial views; & for patella-axial view were taken.

....



X-RAY THIGH AP & Lat. VIEW :
TRANSVERSE FRACTURE OF UPPER
1/3rd OF FEMUR.

LOWER LEG WITH ANKLE JOINT
AP VIEW : SPIRAL FRACTURE
SHAFT TIBIA.





ELBOW JOINT MONTEGGIA FRACTURE -
FRACTURE UPPER SHAFT OF ULENA WITH
DISLOCATION OF PROXIMAL RADIO-
ULNAR JOINT.

COMMUNITED FRACTURE UPPER END
OF TIBIA & FIBULA FRACTURE
Lat. CONDYLE FEMUR ALSO SEEN.





X-RAY KNEE JOINT AND LOWER THIGH :
COMMUNITED FRACTURE LOWER END OF
FEMUR WITH INTERCONDYLAR FRACTURE.

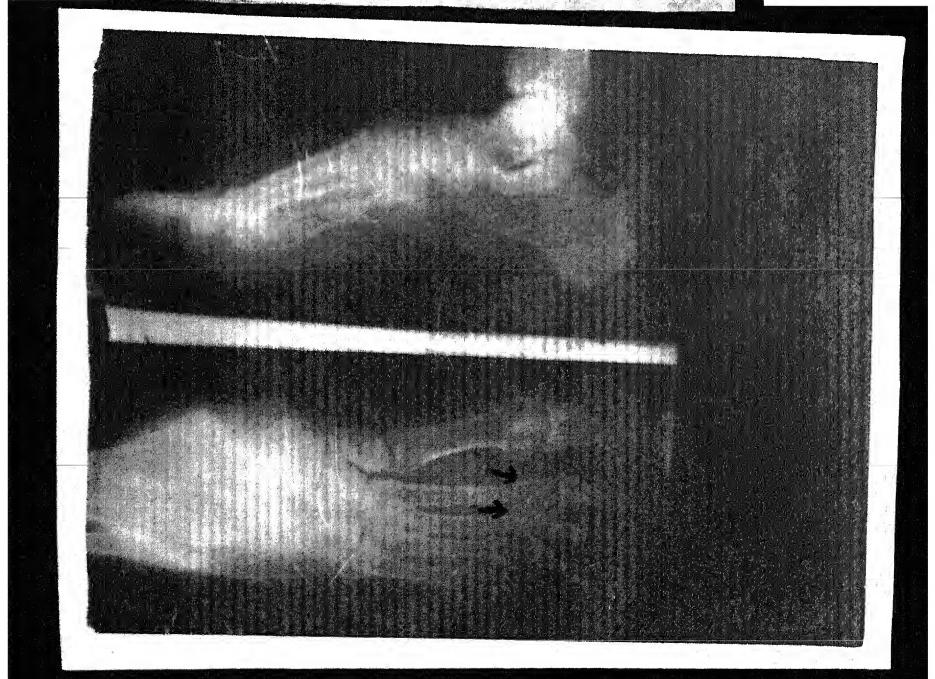


X-RAY KNEE JOINT AND LOWER
THIGH : COMMUNITED FRACTURE
LOWER END OF FEMUR INVOLVING
INTER CONDYLAR NOTCH OF FEMUR.



X-RAY HAND AP & OBLIQUE VIEW :
FRACTURE PROXIMAL PHALANGES
INDEX, MIDDLE & RING FINGER.

Rt. FOOT AP & Lat : FRACTURE
1st, 2nd & 5th METATARSAL
BONES.

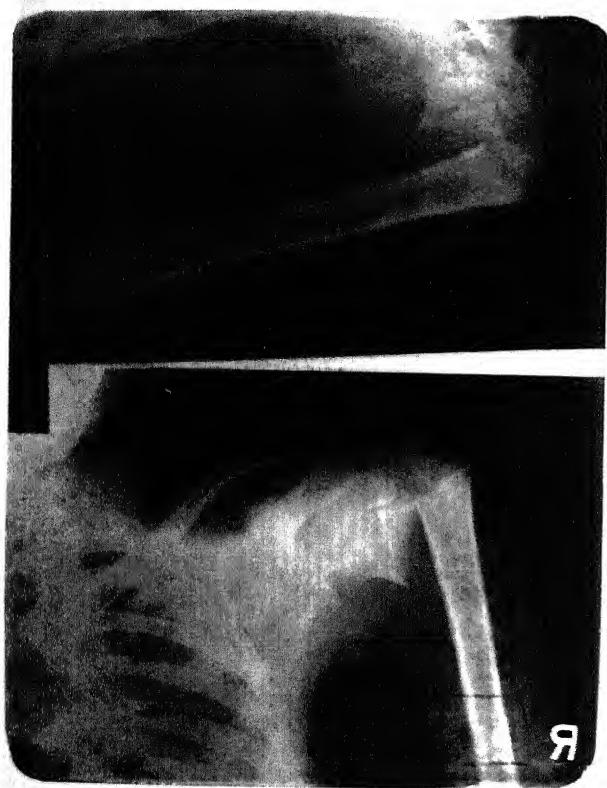




DISLOCATION OF THE ELBOW
JOINT RADIUS & UHLNA BOTH
HAVE DISLOCATED POSTERO-
MEDIALY.

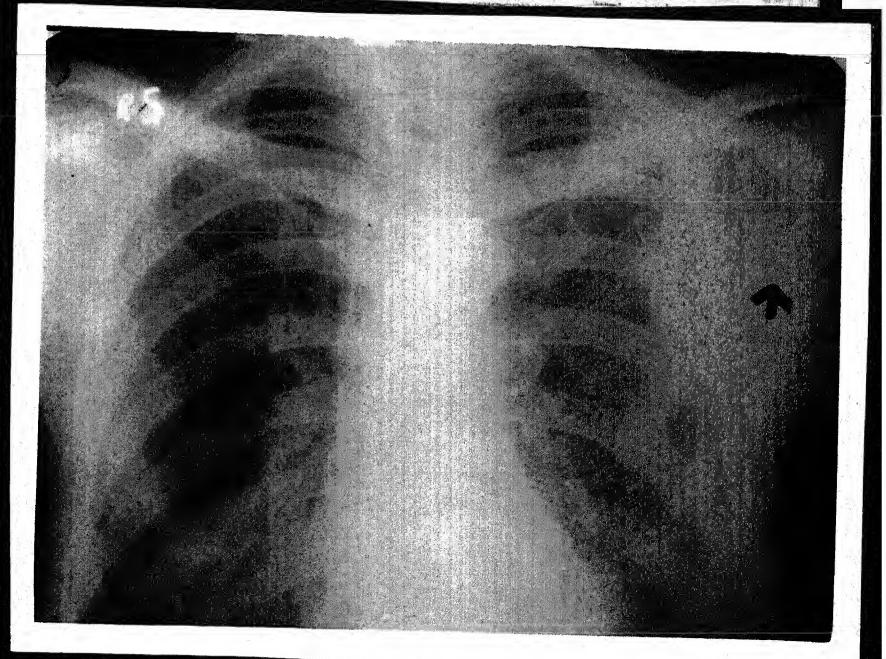
X-RAY HIP JOINT-DISLOCATION OF
HIP-FEMUR HAS BEEN DISLOCATED
SUPERO-POSTERIORLY.

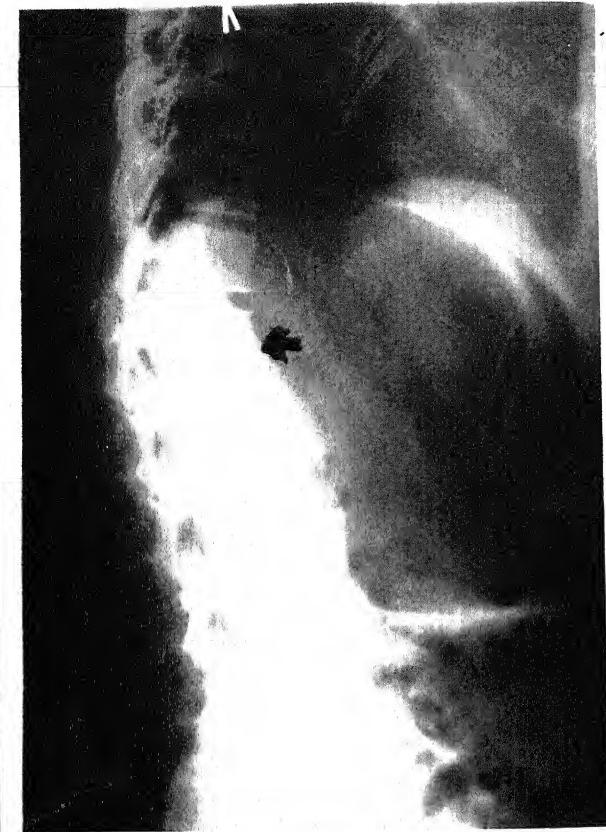




RIGHT SHOULDER COMPOUND FRACTURE-FRACTURE SURGICAL NECK OF HUMERUS WITH DISLOCATION OF THE DISTAL FRAGMENT.

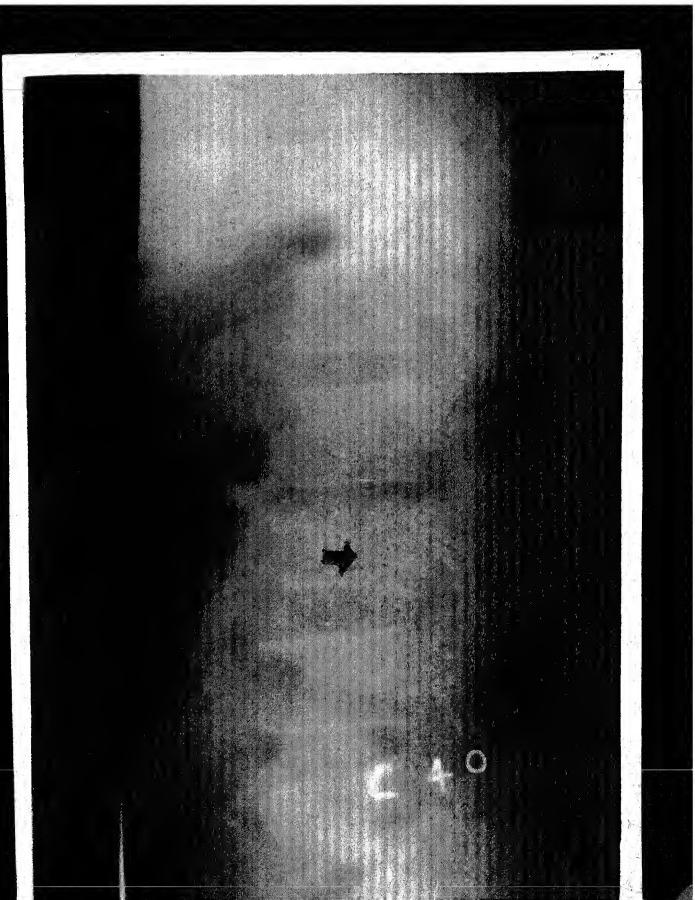
X-RAY CHEST AP VIEW-MULTIPLE RIB FRACTURE LEFT SIDE WITH FRACTURE SCAPULA.



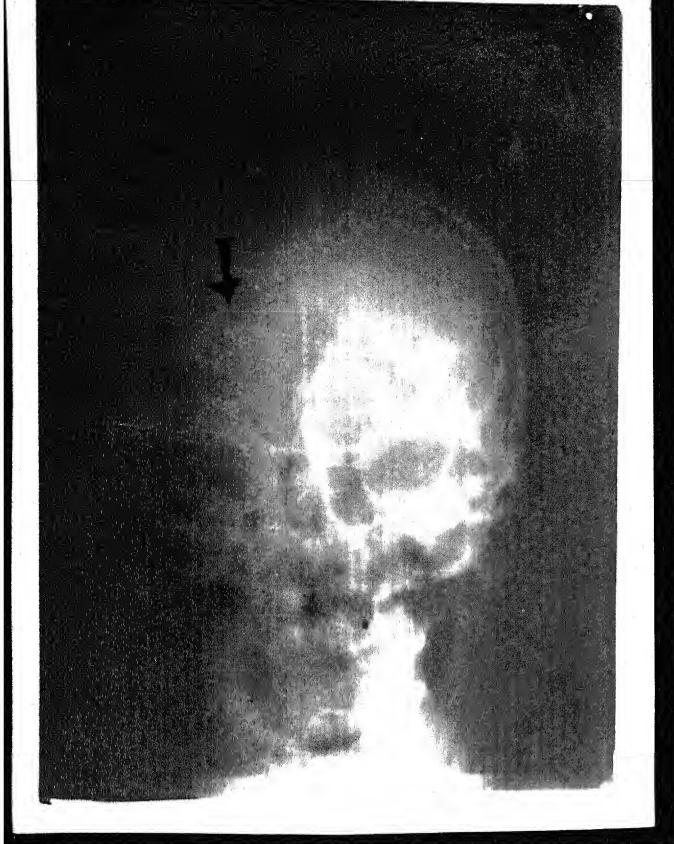


X-RAY DORSO LUMBAR SPINES Lat.
VIEW : THERE IS POSTERIOR
DISLOCATION OF D-12 VERTEBRAE
WITH PIECE OF THE BONE ALSO
SEPARATED FROM THE VERTEBRAL
BODY.

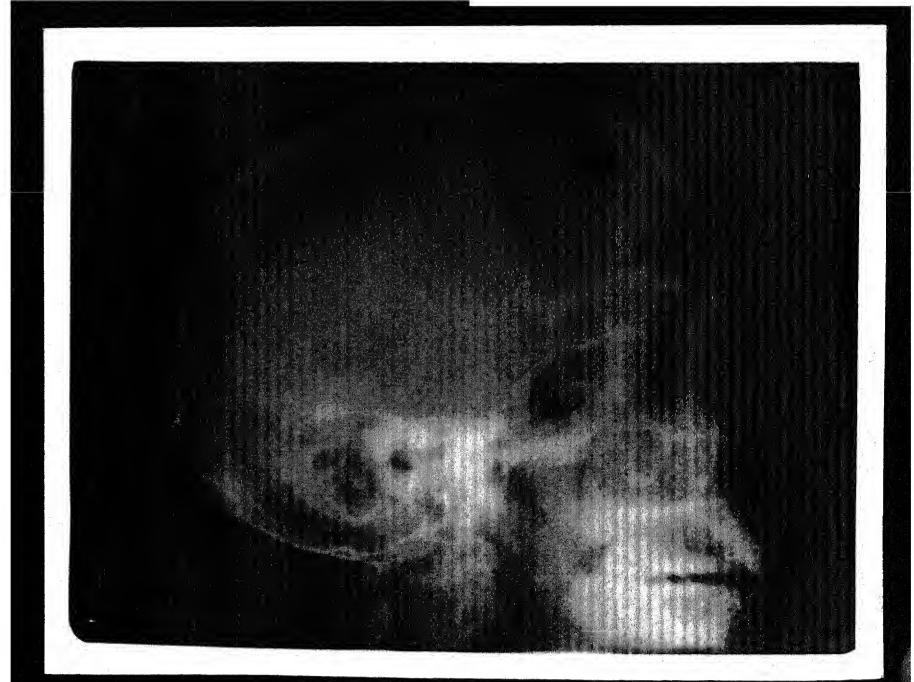
DORSO-LUMBAR SPINE Lat VIEW :
TRAUMATIC COLLAPSE WITH
FRACTURE LINE SEEN BODY
LUMBAR THREE VERTEBRA

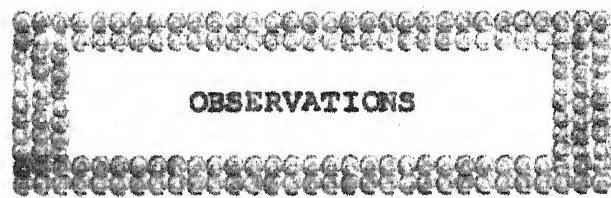


C 40



FRACTURE FRONTAL BONE INVOLVING
ORBITAL PLATE OF FRONTAL BONE,
GREATER WING OF SPHENOID AND
PARIETAL BONE RIGHT SIDE.





OBSERVATIONS

OBSERVATION

The present study "Bone injuries in vehicular accidents : A Radiological study" was carried out in the department of Radio-diagnosis, M.L.B. Medical College & Hospital, Jhansi.

Total accidental cases admitted in the hospital since 1st July, 1990 to 30th June, 1991 were 720. Out of which 212 cases were of road accident.

Out of 212 cases, 131 (61.79%) were males and 81 (38.21%) of females, shown in Table no. 1.

Table - 1
Distribution of cases according to sex

Sl. No.	Sex	No. of cases	Percentage
1.	Male	131	61.79
2.	Female	81	38.21
	Total	212	100.00

All the cases were X-rayed for the site of suspected injury, only 192 (90.57%) cases were found with bony injury (Table no. 2).

Table - 2

Distribution of cases according to the bony injury

Cases	Male	Females	Total	Percentage
With bony injury	118	74	192	90.57
Without bony injury	13	07	20	09.43
Total	131	81	212	100.00

Out of total 192 cases of fracture, the females were 74 (38.57%) and males were 118 (61.43%) (Table - 3).

Table - 3

Distribution of cases with bony injury according to the sex

Sex	No. of cases	Percentage
Male	118	61.43
Female	74	38.57
Total	192	100.00

All the cases of fracture were sub-divided into various age groups as group - I (6-15 years), group-II (16-30 years), group - III (31-45 years), and group - IV (46-60 years).

The maximum number of cases suffered by accidental injury were of group-II (16-30 years). Thus the group-II showed maximum number of cases (67.19%) and minimum (9.38%) in age group-IV (46-60 years) (Table no. 4).

Table - 4
Distribution of cases according to the age group

Age group (years)		No. of cases	Percentage
Group - I	(6-15)	20	10.41
Group - II	(16-30)	129	67.19
Group - III	(31-45)	25	13.02
Group - IV	(46-60)	18	09.38
Total		192	100.00

Two wheelers were responsible for maximum road accidents having 93 cases (48.44%), out of which the motor cycles of the power of 100 cc or above were the most causative factor (30.73%). The three wheelers were at second place with 43 cases (22.40%). Minimum number of accidents were recorded with the heavy motor vehicles (13.54%). Light motor vehicles were the third most common having 30 cases (15.62%), as shown in table - 5.

Table - 5
Cases according to the types of vehicle

Type of vehicle	Number of cases	Percentage
Motor cycle	59	30.73
Scooter & moped	34	17.71
Three wheeler	43	22.40
Heavy motor vehicle	26	13.54
Light motor vehicle	30	15.62
Total	192	100.00

The maximum number of vehicles of road accidents were of two wheelers having 84 cases (43.75%), followed by pedestrians with 50 cases (26.04%). Then came to be cycle riders with accounted (16.15%), victims of heavy motor vehicles were minimum 3 cases (1.56%), as given in table - 6.

Table - 6
**Distribution of cases according to the class
of road users**

Road users	No. of cases	Percentage
Pedestrians	50	26.04
Two wheeler	84	43.75
Three wheeler	17	08.85
Heavy motor vehicle	03	01.56
Light motor vehicle	07	03.65
Cyclist	31	16.15
Total	192	100.00

The fractures of lower limb were the most common bony injuries seen in the vehicular accident followed by upper limb fractures, skull fractures, chest & spinal injuries.

In cases of two wheeler users and pedestrians, the limb fractures were the most common injury. For occupants of truck, severe injuries to the lower limbs were particularly common (table - 7).

Table - 7

Distribution of cases according to the fracture sites

Road users	Lower limb	Upper limb	Skull	Maxillo-facial	Vertebral	Chest
Pedestrian's						
Male	32	24	10	4	3	8
Female	18	10	4	1	0	5
Two wheeler						
Male	51	33	19	9	3	8
Female	26	12	7	5	1	3
Three wheeler						
Male	13	15	4	2	1	3
Female	8	8	2	2	2	1
Heavy M.V.						
Male	3	1	1	-	-	2
Female	-	-	-	-	-	-
Light M.V.						
Male	4	2	3	1	2	3
Female	1	-	1	-	1	-
Cyclists						
Male	13	7	3	2	1	2
Female	3	2	-	1	-	-

There were 172 fractures of the lower limb, out of which 73 fractures were of metatarsal and phalanges, followed by tibia with 42 fractures. Fractures of the femur came at third place with 31 fractures (Table -8).

Table - 8

Distribution of cases according to the fracture site : Lower limb

Femur	Tibia	Tarsal bones	Metatarsal & Phalanges	Total
No. of cases	31	42	26	73

There were 114 cases of upper limb fractures. The fractures of radius and ulna were maximum having 51 cases, followed by humerus with 29 cases. The fractures of phalanges were minimum having 6 cases. Carpals and metacarpal fractures were 9 and 19 cases respectively.

Table - 9

Different types of fractures seen in the upper limb

Humerus	Radius ulna	Carpal	Meta- carpal	Phalanges	Total
No. of Cases	29	51	09	19	06

There were 39 cases of linear fractures of the skull while depressed fractures were found in 15 cases. (Table-10).

Table - 10

Distribution of fractures seen in skull bones

	Linear fractures	Depressed fractures	Total
No. of cases	39	15	54

There were 14 cases of vertebral fractures. The fractures of the lumbar vertebral were maximum having 7 cases followed by 4 cases of dorsal vertebral. The fractures of cervical vertebral were minimum having 3 cases, out of which one case was of fracture of odontoid process of C₂ (Table-11).

Table - 11

Distribution of fractures seen in vertebral injuries

	Cervical	Dorsal	Lumber	Total
No. of cases	3 (1 odon- toid fracture)	4	7	14

In different types of maxillo-facial injuries, there were 15 cases of fracture of maxilla, followed by 8 cases of mandible fracture. Teeth were dislodge in 4 cases.

Table - 12

Distribution of fractures seen in maxillo-facial injuries

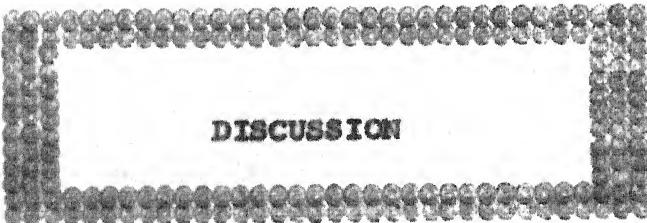
	Maxilla	Mandible	Teeth	Total
No. of cases	15	8	4	27

In all 19 cases of dislocations of joints, elbow joint was dislocated in 15 cases and shoulder joint in 4 cases (Table-13).

Table - 13

Distribution of cases according to dislocation of joints

	Shoulder joint	Elbow joint	Total
No. of cases	4	15	19



DISCUSSION

DISCUSSION

Due to rapid growth of industry, fast mechanisation and busy life, the persons are leading very fast life. Development of roads, rapid urbanisation has lead the people to travel long distance for their bread and butter. Increased number of vehicles and their speed has created the risks of accidents on the roads.

The two wheelers are more prone to accidents than the four wheelers because of their incomplete balance and over loading of vehicles than its capacity, increases the risk of imbalance and accidents. Projected weights and more than two persons are other risk factors.

In our study males found to be more susceptible than females. This is directly explainable because in India the males are mainly out-door workers. Females mostly do house works.

The maximum number of cases were in the age group 16-30 years. This is because the adolescent and young age group are more frequently going outside. The number of out door visits are more and distance covered more than the other age group.

The maximum number of cases suffered road accident injury between 2-7 P.M. This is because the

roads are busy at this time as well as the darkness occur after 6 P.M., which increases the risk of driving on the dark road. Improper use of blinkers and dippers of light, little light on the roads are the causative factor for it.

The motor cycle are the most common culprit of the accidents above the 100 c.c. power. Easy & very early acceleration of speed, tendency of driver to overtake the speeding vehicle in an improper way is the causative factor to it. Lack of traffic sense is also a great causative factor.

Among the pedestrians, the children between the age group between 6-15 years are common victims of accident. Causes are lack of knowledge of traffic rules, absence of foot-paths over the roads, absence of Zebra crossing sign and its demarcation. Moreover, the drivers of heavy vehicle do not respect the signals too.

The lower limbs are prone to get injury. The explanation for it is that sudden sense of danger make pedestrians to run leading to be hit at lower limbs.

The head on collision accidents were fatal either the victims die~~s~~ on the spot or moreover, if alive suffer head or chest injury.

Fracture skull were commonly linear fracture whereas as in the chest injury, rib were commonly liable to get fractured.

In India there is not a strict provision and implementation of law regarding frequent medical check up of drivers. Refractive errors has added the risk of accidents more.

The use of drugs frequently, alcohol add an important risk factor for accidents. Lack of strict imposition of fine or imprisonment for drivers, who drive after consuming the alcohol are the culminating factor of accidents. Further non availability of sofisticated instruments for the estimation of alcohol in breathe of driver more than the quantity of danger, increases the risk of accidents.

Pits, holes, pebbles & bumps over the roads, improper signals and signs of danger increase the causative factor. Moreover, the sexy attractive posters at the sides of road are also important factor to divert the attention of drivers leading to accidents.

Vehicle drivers violate the rules because many are ignorant. They are ignorant possibly because, they feel that they do not need to be knowledgable. After

all, many drivers have neither taken a practical training, nor being strictly tested before issuing the Driving Licences.

In the National Safety check up Programme in United States in 1959 (National Safety Council, 1960) 20% four wheelers were not found to be road worthy.

In study of vehicular defects in eleven states of United State (National Safety Council, 1960) about two out of five vehicles tested were found unsafe, among individual states, four had vehicle rejections exceeding 50%, and the highest was 72%. Head lights lead the test, being defective on 24 percent of all vehicles. In order of frequency defective brakes-17 percent, rear light-15 percent, steering-10 percent, glass-5 percent; and tires-1 percent.

The two wheelers drivers do not wear helmet and the wheels are of small size, so that they have more chances of slipping while taking a turn. Roaming of the cattles on the roads is also a major contributing factor. The condition of the roads are very poor. The roads are narrow, bumpy and encroached by hawkers and shopkeepers.

For every 220 vehicles, there was one mishap in Delhi, compared with one for every 95 in Madras and 120 in Calcutta. 88 vehicles including bicycles, piled on the average on every kilometre of road in Delhi compared with 767 in Madras. This means the traffic density in Madras was nearly ninefold of that in Delhi.

But high traffic density need not necessarily mean that the number of accidents must also be high. If most people are cautious and disciplined road users, traffic density will have little impact on the number of mishaps (Gautam Ghosh).

CONCLUSIONS

CONCLUSIONS

The present study "Bone injuries in vehicular accidents: A radiological study" was carried out in the department of Radio-diagnosis, M.L.B. Medical College & Hospital, Jhansi. Total 212 males and females were X-rayed for suspected fracture in vehicular accidents. The following conclusions were made :

1. Males were found to be more vulnerable to bone injuries than females.
2. The maximum number of cases were in the age group of 16-30 years.
3. The young and adolescent persons are more frequently out going and due to rash driving are more prone to accidents.
4. Two wheelers, especially the motor cycles of 100 cc or above were mostly involved.
5. Due to early acceleration and speed and tendency of the drivers to overtake, is the most important factor for the accidents.
6. Two wheelers and pedestrians were the main victims.
7. The commonest types of injuries seen in the vehicular accidents were limb fractures followed by skull fractures, chest and spinal injuries.

8. Limb fractures were the most commonly seen in the two wheelers and pedestrians.
9. The fractures of metatarsal bones and phalanges were most common in lower limb fractures.
10. In the case of upper limb, the fractures of radius and ulna were most common.
11. In the skull bones the linear fractures were the most common.
12. In the spinal injuries, fractures of the lumbar vertebrae were most common.
13. In the maxillo-facial injuries, the fracture of mandible bone was most common.
14. Elbow joint was most commonly dislocated.
15. Compound fracture was the most commonly seen in the vehicular accidents.
16. Most of the accidents occurred during evening hours (2-7 P.M.) followed by early night hours (7-12 P.M.). This is because the roads are busy at this time as well as the darkness occur after 6 P.M. Lack of use of blinkers and dipper of light, little light on the road, are the other causative factors.

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